

What is claimed is:

1. A method of manufacturing a vertical cavity surface emitting laser comprising:

providing a substrate;

forming a first parallel stack of mirrors on the substrate;

forming an active and spacer layer on the first parallel mirror stack;

forming a second parallel mirror stack on the active and spacer layer;

etching the second parallel mirror stack to define a mesa shaped structure;

oxidizing the mesa shaped structure to form a current-confining central region in the mesa; and

etching the outer sidewalls of the mesa structure to remove oxidized material.

2. The method as defined in claim 1, wherein the step of etching the second parallel mirror stack further etches at least a portion of the first parallel mirror stack.

3. The method as defined in claim 1, wherein the step of etching the sidewalls removes at least one micron of sidewall depth.

4. The method as defined in claim 1, wherein the step of etching the sidewalls removes material from the sidewall so that the sidewall is substantially vertical throughout the first parallel mirror stack.

5. A method as defined in claim 1 wherein the step of forming the second mirror stack includes depositing alternate layers of high and low aluminum content AlGaAs in at least a portion of the second mirror stack and the step of oxidizing the mesa structure includes oxidizing at least the high aluminum content AlGaAs layers.

6. A method as defined in claim 5 wherein the step of oxidizing the high aluminum content AlGaAs layers includes flowing nitrogen gas with added water moisture over the outer sidewalls at a temperature of approximately 400 degrees centigrade.

5. A method as defined in claim 1 wherein the step of etching selected layers of the second mirror stack adjacent the outer sidewalls reduces the electrical conductance of a portion of the second mirror stack.

6. A method as defined in claim 1 wherein the step of etching the sidewalls includes etching the oxidized sidewalls of at least the high aluminum content AlGaAs layers.

7. The method as defined in claim 1, wherein the step of etching the sidewalls is performed by wet etching.
8. A method as defined in claim 7 wherein the step of wet etching includes etching with dilute HF with DI water.
9. The method as defined in claim 1, wherein the step of etching the sidewalls is performed by dry etching.
10. The method as defined in claim 1, further comprising depositing a layer of dielectric material on the mesa shaped structure to confine current flowing in the mesa shaped area; etching an opening through the dielectric layer in the mesa shaped structure; and depositing material on the mesa shaped structure including optically transparent, electrically conductive material defining an electrical contact window to control current distribution within the laser to the desired current configuration, the dielectric material and the optically transparent, electrically conductive material being deposited to an optical thickness which provides the desired reflectivity profile for the mesa shaped structure.

11. A method of fabricating a VCSEL comprising:

forming a semiconductor device structure with a first stack of mirrors and a second stack of mirrors with an active area sandwiched therebetween, the second stack of mirrors being a mesa structure having an upper surface and outer sidewalls;

forming at least one oxide region extending into the sidewalls of the mesa structure, including a strain induced region; and

etching the sidewalls of the mesa structure to remove at least a portion of said strain induced region.

12. A surface emitting laser comprising:

a substrate having top and bottom surfaces;

a first stack of mirror layers located upon said substrate top surface, said first stack layers of alternating indices of refraction;

an active layer located upon said first stack, said active layer having a mesa extending above an adjacent base layer portion of said active layer;

a second stack of mirror layers located upon a top surface of said mesa, said second stack layers of alternating indices of refraction; and

an etched oxide layer located peripherally about said mesa and upon said adjacent base layer portion immediate said mesa.

13. A method of manufacturing a vertical cavity surface emitting laser comprising:

providing a substrate;

forming a first parallel stack of mirrors on the substrate;

forming an active and spacer layer on the first parallel mirror stack;

forming a second parallel mirror stack on the active and spacer layer;

etching at least the second parallel mirror stack to define a structure;

oxidizing the peripheral sidewalls of the structure to form a current-confining central region in the structure; and

etching at least a portion of the outer sidewalls of the structure to remove oxidized material.